is the impossibility of eliminating some forms of "systematic" error, which are too likely to be variable to be strictly systematic, such as the difference between the indications of a thermometer, under various conditions of exposure, and the real temperature of the air. Another is an error neither accidental nor systematic, but due to the fact that the data are meteorological; a good example of this is afforded by the mean diurnal variation of air temperature as shown on (*a*) overcast or (*b*) cloudless days.

Dr. Ryd regards harmonic analysis applied to such data as an excellent interpreter, but a very untrustworthy probe. The known periods—the day and the year—are unexceptionable, and the variation from hour to hour in one case, and from day to day, or preferably from "pentad" to "pentad," in the other, are obviously fit subjects for analysis. Dr. Ryd prefers to use both sine and cosine terms instead of the usual transformation, because the determination of mean error is more direct when two constants enter similarly. This is clearly important, as the mean error is a vital consideration. Analysis for testing a real period, such as one of the lunar periods, on the meteorological data is not quite so risky as tentative fishing for an unknown period, in which case at least one coefficient, according to Dr. Ryd, must be five times its probable error before it can be regarded as likely to be real.

The brochure is divided into two sections, the first dealing generally with such routine problems as the computation of the mean error, smoothing and adjustment of observational data, and harmonic analysis, with an additional chapter on secondary minima and maxima in the annual variation of the temperature, in which the author deals with the proverbial "Ice-men" of May 11, 12, and 13, and exposes the weakness of Dove's supposed proof of the reality of this legendary phenomenon. The second part deals fully with "mechanical" adjustment, factors of variation, and suggestions on the choice of adjusting formulæ, of which several are given, and a longer chapter is devoted to the working out of four concrete examples, viz. the hourly inequality of air temperature, Greenwich, 1849 to 1868; and of pressure, Greenwich, 1854 to 1873; the annual inequality of pressure, Batavia, 1876 to 1905; and the annual variation of temperature, Copenhagen, 1875 to 1910, the last being a case of partial data—only three observations at fixed hours of the day, instead of the full set.

Dr. Ryd reminds the reader that when data such as July air temperature for twenty years are entered in rows for days and in columns for years, they cannot be analysed similarly in both directions, inasmuch as the successive days are not independent, while the columns are. He also discusses at some length the "order" to which harmonic analysis, if used for adjustment, should be pushed, with hints for saving labour; but on the whole he prefers the "mechanical" adjustment with a suitable formula in the majority of cases, and thinks this method less liable to introduce new errors into a problem. W. W. B.

NOTES.

SIR ARCHIBALD GEIKIE, O.M., who has long been a correspondant of the Paris Academy of Sciences, has now been elected an associate member of the academy.

THE *Times* announces that the report of the Departmental Committee on salaries of teachers will be issued within the next few weeks. The report of Sir J. J. Thomson's committee on science teaching is also expected at an early date.

THE council of the Royal Meteorological Society has awarded Dr. H. R. Mill the Symons gold medal for 1918 "for distinguished work in connection with meteorological science." The medal will be presented to Dr. Mill at the annual meeting of the society in January next.

AT the meeting of the Chemical Society to be held on December 6, Dr. F. L. Pyman will deliver a lecture entitled "The Relation between Chemical Constitution and Physiological Action."

THE Hon. Sir Charles Parsons, member of council of the Institute of Metals, is to give the eighth annual May lecture before the institute next spring. He will deal with the subject of the formation of diamonds, with the artificial production of which he has been experimenting for more than thirty years.

THE death of Mr. Alexander Adamson is announced in *Engineering* for November 23. Mr. Adamson was born in Glasgow in 1846, and took a prominent part in the evolution of the modern Atlantic liner, and was later identified with the early stages of development of the Barrow works, now the most important naval armament and munition works in the kingdom. He served for some years on the council of the Institution of Naval Architects.

THE death is announced in the *Chemist and Druggist* of November 24 of Prof. Charles Caspari, jun., dean of the Department of Pharmacy in the University of Maryland, and Food and Drug Commissioner of the State of Maryland. Prof. Caspari's "Treatise on Pharmacy" is well known on this side of the Atlantic. In addition, Prof. Caspari was one of the editors of the U.S. Dispensatory and a member of the Revision Committee of the United States Pharmacopœia.

WE regret to note that *Engineering* for November 23 announces the death, from heart failure, of Mr. Peter Denny, a member of the Dumbarton family which has done so much work to establish shipping and marine engineering on a truly scientific basis. In this work Mr. Denny took an effective part, and also fulfilled in a marked degree those varied duties of an employer of labour connected particularly with the social life of the worker. Mr. Denny, who was in his sixty-fifth year, joined the Institution of Naval Architects in 1880.

AT the monthly meeting of the Zoological Society of London, held on November 21, it was stated that during the months of August, September, and October 281 additions had been made to the society's menagerie. Of these, perhaps the most interesting are a brindled gnu, from South Africa, and an anoa, from Celebes. Having regard to the times, one can scarcely be surprised at the announcement of a falling-off in receipts during 1917. From January 1 to October 31 this amounts to 3806*l*. Happily, the number of fellows elected and re-admitted shows an increase of thirteen, as compared with the corresponding period last year.

IN his presidential address to the Royal Statistical Society on November 20 Sir Bernard Mallet referred to the damage which the present war must inflict upon this and other nations. The United Kingdom has lost by the fall in births more than 500,000 potential lives, while Germany during the same period has lost 2,600,000, and Hungary 1,500,000. At the outbreak of war the population of the Central Empires was about two and a half times as great as that of the United Kingdom, but their losses of births have been apparently ten times as great. The reason for this difference may be that while the poorer classes in this country have never experienced more favourable conditions, the Germans, if all indications are to be believed, have suffered to such an extent as to affect seriously the general health of the population. The infant mortality in Germany has been some 50 per cent. higher than in this country.

THE *Revue Scientifique* announces the death on November 4, at fifty-eight years of age, of Prof. R. Nicklès, professor of geology in the University of Nancy. Early in his career he investigated the geology of the provinces of Alicante and Valencia, in Spain, and in 1891 this was the subject of his doctoral thesis. He also published important memoirs on the Lower Cretaceous ammonites which he had collected in Spain. While professor at Nancy he collaborated with the Geological Survey of France, and devoted special attention to the coalfields buried under Mesozoic strata in Lorraine. By purely scientific work he was able to indicate the most likely spots for successful borings, and the result was the discovery of valuable coal-seams at a depth between 700 and 800 metres. Prof. Nicklès communicated several notes on this subject to the Academy of Sciences from 1905 to 1909, and the value of his researches was acknowledged by the Geological Society of France, which awarded to him the Gosselet prize in 1911.

BY the death early in November of Lieut. Cyril Green on the Palestine front a botanical career of much promise is cut short. Cyril Green was the youngest son of the late Rev. T. Mortimer Green, registrar of University College, Aberystwyth. At this college, where he studied botany under Prof. R. H. Yapp, he graduated in science in 1911, receiving a first class in botany honours. In 1912 he joined the staff of the Department of Botany at University College, London, where he showed marked abilities as a teacher. Green's investigations lay especially in the field of plant ecology, and included a detailed survey of Borth Bog, an area of no little botanical interest. He also worked at the physiological anatomy of water plants. Since the outbreak of the war he had been appointed head of the Department of Botany in the new Welsh National Museum at Cardiff, a position which was to have been held open for him until the conclusion of hostilities. Already before the war Green held a commission in the London University O.T.C., and was transferred to the Royal Sussex Regiment. Severely wounded in action in France in May, 1915, he was, on recovery, attached to an officers' cadet battalion as instructor. In June, 1917, he was sent to Egypt, and fell in action in the recent advance in Palestine. This Egyptian campaign had a special interest for Green, as it brought him in contact with a flora of which he had previously gained some knowledge in botanico-antiquarian studies carried out by him in connection with the Department of Egyptology at University College. The last correspondence received by his colleagues related to this flora. His brother, Capt. H. M. Green, of the Welsh Regiment, has been posted as missing since Suvla Bay.

THE proposed organisation of the clay industries, discussed at a meeting of employers at the Guildhall on November 23, would undoubtedly have a beneficial and far-reaching effect if properly carried out, as seems highly probable. The keynote of the speakers (among whom were Messrs. H. Lewis, J. H. Whitley, and G. J. Wardle) was cordial co-operation between capital and labour, with the ideal of substituting for the proved general inefficiency of individualism a sense of industrial solidarity for national service. Mr. Wardle intimated that the scheme does not propose to pool capital or profits, but rather technical knowledge, the inadequacy and restricted diffusion of which have been a very serious obstacle to British industry. Men of science long ago proclaimed this disadvantage, but their strenuous efforts to bring about an improvement failed almost entirely. Now, under the stress caused by a terrific world-conflict, a flood of new light has been thrown on many matters which used to be subjects for bitter controversy. Standardisation would unquestionably tend to check waste, but, as Mr. Wardle remarked, it must not stand in the way of invention and new processes. It is noteworthy that Mr. Lewis handsomely acknowledged that no grant of public money had been more usefully employed, or was likely to be productive of greater results in the future, than that voted for research purposes. This is certainly no less true of money provided for research in connection with the clay industries than of contributions made towards research in other directions.

PROF. LEONARD HILL has in Monday's *Times*, November 26, an interesting letter on scientific rationing. He points out that as a machine the efficiency of a man is about 25 per cent., three times as much heat being produced as external work done. During complete rest in bed, fasting, the energy spent in the internal work of the body is determined. This averages one Calorie per kilogram of body-weight per hour for all average people—about half the expenditure of the man doing light work. All unproductive people, idlers, old, and invalid, can save a large part of the food they eat by lying in bed warm and at rest. With regard to different classes of workers, the same measure of meat is not suitable for them all, because meat, far more than carbohydrate or fat, stimulates the living cells to live at a vigorous rate. Prof. Hill states that experience shows that the higher class of brain-workers, the organising and driving power of the nation (which must not be lessened), secures its energy most easily out of a diet containing a higher proportion of meat, and that carbohydrate is utilised very well by producers of mechanical work. He says that the Yapp ration, considering the difficulty of securing all the rationed foods, affords scarcely more than half the energy necessary for productive labour. "At current prices flour yields more than 700 Calories for a penny, meat and cheese about 100, margarine 300. To ration bread and flour, then, should be the last measure of emergency; the physiologist cannot conceive rationing these while luxury trades continue and fields are not fully cultivated or ships built to the utmost; while spirits are distilled from foodstuffs for munitions, and great stores of alcohol are left untouched; while the problem of transport of potatoes and swede turnips to the urban populations has not been solved; while shipping is not used to the maximal advantage to maintain the importation of cereals."

Fas est et ab hoste doceri. In an article on "A Central Bureau of Commercial Intelligence" in the November issue of *United Empire*, Major Cuthbert Christy urges us to follow the example of Germany in taking steps to turn to account with the least loss of time and energy the resources of the British Empire. The point which he chiefly insists on is what may be comprehensively described as the indexing of knowledge. The parts of the Empire that he has principally in view in making his present suggestions are those in Africa, especially tropical Africa. "The once 'Dark Continent,'" he says, "is certainly the richest of the five, though the fact may be known to few, not only in mineral wealth, but also in agricultural possibilities, and must in the near future, when central and trans-African railways are constructed, become a field of vast undertakings, of thriving native industries, and perhaps the world's chief source of raw materials." What he would have in order to hasten the utilisation of these resources is, first, a central institution in London which, according to his ideas, would be merely a fuller development of the Imperial Institute on the lines of the Hamburg Colonial Institute, of which he gives an account, and, secondly, Colonial sub-centres which the chief centre would supply with abstracts of the voluminous information already collected. "It should be obvious that where the information and training are most useful is at the source of the raw material." For this idea also he acknowledges German origin, referring to his own experience at the fine botanical gardens and laboratories at Victoria, in the German Cameroon colony. All this seems well worthy of consideration, but we would add one suggestion, that the information thus collected and distributed should include, so far as possible, estimates of the cost of production of the Colonial commodities, expressed not merely in money, but also in amount of labour employed. Production per head is an even more important rubric than production per acre.

THE inaugural address on "Science and its Functions," delivered by the chairman, Mr. A. A. Campbell Swinton, at the Royal Society of Arts, on November 21, contained an appreciative reference to the work of Sir Henry Trueman Wood, who recently resigned the post of secretary of the society held by him for thirty-eight years. Mr. G. K. Menzies, who has been Sir Henry's assistant for the past nine years, succeeds him as secretary. The chairman then reviewed the progress of science in the past, showing that the most primitive peoples had applied a knowledge of natural laws in an elementary way in fashioning their weapons and implements. Later, in the kingdoms of Babylon, Assyria, and Egypt, and later in Greece, various sciences were studied, and the lecturer mentioned instances of their application to practical problems. Turning to more recent periods, he contrasted the condition of this country in 1754, the year in which the society was formed, with those prevailing to-day. The society was older than many familiar discoveries and inventions. Dealing with the problem of scientific education, Mr. Campbell Swinton pointed out that many of the greatest discoveries and inventions had been made in the past by men with little formal scientific training, and in fields quite outside their ordinary vocations. Thus James Watt was a maker of mathematical instruments, George Stephenson a colliery fireman, Arkwright a barber. Edison began life as a railway porter. Cavendish, Boyle, Sir William Herschel, and other great workers in the field of pure science might be described as gifted amateurs. No rigid distinction could be drawn between pure and applied science. Wireless telegraphy afforded a good instance of purely theoretical work leading to unforeseen vast practical results, and the same would doubtless apply to recent researches in molecular physics. Finally, the lecturer pointed out that the acquisition of wealth was not necessarily a disservice to humanity. Inventors and men of science by their discoveries created wealth, and in general received but a small fraction of the riches which their efforts conferred on the community.

IN the November issue of *Man* Mr. Harold Peak describes a figure recently acquired by the Borough of Newbury Museum. It is said to have been discovered at Silchester, and it has all the appearance of being contemporary with the Romano-British town of Calleva. It is of dark bronze, 12 cm. in height, and represents a male deity or Lar, standing erect, with the head surmounted by a sun with twelve rays. The right hand holds three ears of some grain, probably wheat, while the left, which is raised to the level of the shoulder, but with the elbow flexed, is bearing what seems to be a crescent moon attached to a handle. In the centre of the crescent is a small figure with two faces, the head surmounted by what appears to be a pair of short horns.

MR. N. W. THOMAS, in the November issue of *Man*, excusing the brevity of the account of secret societies in West Africa, published in his recent report, remarks that he was about to be initiated into the Poro Society, which is by no means banned by the Government, and carries on its rites with as little secrecy as a Masonic lodge, had he not been prevented by an order issued by a subordinate official to the chief forbidding him to allow Mr. Thomas to go near Poro, Bundu, or any other sacred bush. This case, now brought to the notice of the local Government, should lead to the reconsideration of such orders, which throw difficulties in the way of ethnographical investigations carried on by the official ethnologist.

MR. H. LING ROTH has issued in the second series of Bankfield Museum Notes, No. 9, the second part of his "Studies in Primitive Looms," this instalment being devoted to those of Africa. He finds no fewer than seven forms of loom in use in the continent: the vertical mat loom, the horizontal fixed heddle loom, the vertical cotton loom, the horizontal narrow band treadle loom, the pit treadle loom, the Mediterranean or Asiatic treadle loom, and the Carton loom. These forms are easily distinguishable, and occupy distinct areas, although in parts they overlap considerably. The most primitive of all the forms, the vertical mat loom, has a wide distribution, extending from the west coast to the east of the Great Congo Basin. The paper is lavishly illustrated by excellent sketches, and forms a valuable contribution to the study of the history of primitive weaving.

IN a paper in the *Geographical Journal* for November (vol. l., No. 5) Miss Newbigin discusses the relationships between race and nationality. After pointing out that the physical differentiæ of race, at least as they occur in the sub-races of Europe, are of little importance under modern conditions, Miss Newbigin maintains that man's power of adaptive response to his environment is incompatible with the view that the practice of a peculiar mode of life endows him with certain fixed characteristics, such as are cited by many writers as racial characteristics. Nationality is not permanent and unalterable. What makes a nation, according to the author's argument, is not only race, or religion, language, history, or tradition, but, partially at least, community of economic interests dependent upon geographic factors. One of the most important of these factors is the existence of an area capable of supporting a large population surrounded by one which becomes progressively less fitted to support such a population. Among nation-making factors she emphasises the existence side by side, within the belt favourable to population, of the most fertile lands, of those best fitted to form seats of industries, and of great nodal points focussing internal and external lines of communication.

IN May, 1903, Dr. C. Gorini, writing in the *Rendiconti del R. Istituto Lombardo* (vol. xxxvi., p. 601), directed attention to the property possessed by the bacillus of typhus and certain other bacteria of climbing up the surface of the agar used for the culture, while other species failed to do so. This property was afterwards used by Choukevvich, Metchnikoff, and other bacteriologists for isolating the climbing species, notably Proteus, and separating them from others which do not possess the same power. In a recent number of the Lombardy *Rendiconti* (vol. xlix.), Dr. Gorini details further experiments on the method, and gives a general *résumé* of the observations of other writers bearing on the subject.

THE possibility of the transmission of plague by bed-bugs is the subject of an investigation by Lt.-Col. Cornwall and Asst.-Surg. Menon (*Indian Journ. Med. Research,* vol. v., No. 1, 1917). Their conclusion is that the likelihood of the transmission of human plague by bugs in biting under natural conditions is small. The reason for this is that though plague bacilli may survive in the stomach of the bug for nearly six weeks, bugs cannot regurgitate their stomach contents in the act of feeding. If, therefore, bugs transmit plague by biting, they must do so by washing out with the salivary secretion plague bacilli stranded in their sucking tubes, and the bacilli are unlikely to remain in the sucking tube for long after an infected feed.

AN important paper on the zoological position of the Sarcosporidia is contributed by Mr. Howard Crawley to the Proceedings of the Academy of Natural Sciences of Philadelphia (vol. lxvii., part 3). The author arrives at the conclusion that the Sarcosporidia are to be regarded, not as Neosporidia, but as Telosporidia, and as being nearly related to the Coccidiomorpha, a conclusion exactly opposite to that arrived at by Minchin, who regarded these parasites as nearly related to the Myxosporidia. But apart from problems of taxonomy, the author has much to say in regard to this group which is based upon original research, though he has failed to throw any further light on the migration of the product of the zygote into the muscle-cells.

THE skull of the lesser cachalot (*Kogia breviceps*) has recently been investigated by Dr. H. von Schulte, who records the results of his labour in the Bulletin of the American Museum of Natural History (vol. xxxvii., article xvii.). The material at his disposal comprised the skull of an adult female and that of a calf about two-thirds grown, and these are compared with those already described in other museums. The author finds that the cranium of Kogia is subject to a considerable degree of fluctuating variation, and that it is impossible to distinguish sexual characters therein. Finally, he holds that a comparison between the skulls of Kogia and Physeter shows the former to be the more highly specialised form, though both have deviated in different directions from the common ancestral type.

AN interesting account of the high alpine flora of the Upper Mekong in N.W. Yunnan is given by Mr. George Forrest in the *Gardeners' Chronicle* for October 27. Dwarf rhododendrons are the dominant feature of the region from 12,000 to 15,000 ft., forming a moorland vegetation very similar in appearance to our own heather moors. Of the 7000–8000 species of plants already collected by Mr. Forrest, fully 20 per cent. he estimates are rhododendrons. Their wealth, he writes, "is almost incredible . . . each individual seems to have a form or affinity on every range and divide differing essentially from the type." One of his new species, a shrub 1–2½ ft. high, bears masses of brilliant yellow flowers, and was found covering many acres of country.

Kew Bulletin Nos. 4 and 5, which are issued together, are almost entirely occupied by an account of the genus Strychnos in India and the East by the assistant-director. Ninety-two species are now known from this region, twenty-two being described in this paper for the first time. The genus is broken up into four sections on well-marked floral characters, and it is in the section with long-tubed flowers and large fruits that the economic species are to be found. *Strychnos Nux-vomica,* it is found, occurs wild, not only in South India and Ceylon, but also in Cochin-China. The plant from Burma and Siam formerly considered to belong to this species proves to be quite distinct, and is described as a new species under the name of *Strychnos Nux-blanda.* It is of interest that the seeds of this tree, which resemble those of the well-known Nux-vomica, contain practically no alkaloids. Another economic species, *S. Gautheriana,* from French Indo-China, about which much confusion has existed, has also been satisfactorily determined with the help of material at Paris. Several interesting questions of geographical distribution are raised in the introductory pages, and the paper is illustrated with text figures.

IN the *Agricultural Journal of India,* vol. xii., part iii., Messrs. J. H. Barnes and B. Ali give an account of investigations which demonstrate that the progress of reclamation of alkali soils can be effectively tested by measurements of the activity of the oxidising, nitrifying, and nitrogen-fixing bacteria in the soils. Mr. J. N. Sen contributes observations made at Pusa on the occurrence of infertile patches under trees, which indicate that numerous factors are involved, such as competition for light and food, production of toxins, and accumulation of soluble salts. Mr. H. E. Annett contributes the results of further experiments in the improvement of the date-palm sugar industry. The deterioration of the juice by fermentation during collection was found to be largely obviated by coating the earthenware collecting pots internally with lime. Metal buckets, as used in North America for maple juice, were found to be very unsatisfactory. The dark colour of the date-palm sugar (*gur*) was found to be due to the alkalinity of the fresh juice. When this was neutralised before concentrating the juice a very satisfactory light-coloured *gur* was obtained.

MR. T. A. JAGGAR, JUN., director of the Hawaiian Volcano Observatory, occupies sixty pages of the *American Journal of Science* (vol. xliv., p. 161, 1917) with an important and well-illustrated account of recent "Volcanologic Investigations at Kilauea," summarising much that has been published in the Bulletin of the observatory from time to time (compare NATURE, vol. xcviii., p. 436, and vol. c., p. 92). The large photographs of two aspects of Halemaumau, by Mr. Morihiro, of Hilo, are reproduced in a very impressive plate.

THE late Mr. Clement Reid's memoir on the Bournemouth district, published by the Geological Survey in 1898, was the result of his mapping of the superficial deposits; but Sir A. Geikie, as was stated in the preface, then looked forward to the issue of a more detailed account of this very interesting area. Mr. H. J. Osborne White has now prepared a second edition, which is practically a new work (Mem. Geol. Surv., Explanation of Sheet 329, 1917, price 2*s.*), as a guide to the colour-printed map which appeared in 1904. The observations and co-operation of Dr. W. T. Ord, of Bournemouth, have been largely utilised, and the gravels with Palæolithic implements receive just attention. They are regarded as the deposits of streams of much greater volume than those of modern Hampshire. The most effective passage in the memoir remains that in Sir A. Geikie's preface, where he compares the Ordnance Survey map of "Bourne Mouth" in 1811 with that issued in 1893. The present geological map, with its colouring of the plateau gravels of Winton and Boscombe, and of the Bagshot Sands of Parkstone, affords a good explanation of the human development of the district.

ACCOMPANYING the main coal seams in some parts of England are often found seams of inferior coal substances. These frequently resemble cannel coal more or less closely, and are distinguished by giving a large proportion of a very voluminous ash, making them useless for ordinary fuel purposes. In some districts the carbonaceous portion, considered apart from the ash, is comparable in composition with that of a good coal, so that the substance contains a large amount of potential energy, which is at present wasted. Experiments have therefore been made in order to ascertain whether by low-temperature distillation of the waste coal any portion of this potential energy can be made available in the form of oil fuel or other valuable products. An account of these experiments is given by Mr. T. F. Winmill in the Journal of the Society of Chemical Industry for August 31. The main bulk of the liquid products obtained was a hydrocarbon oil of a new type, having a specific gravity of from 0·794 to 0·910, and boiling between the range 150° to 360° C.; it proves to be a mixture of unsaturated and polymethylene hydrocarbons. The only obvious use for the mixture is as a fuel oil. Unfortunately the experiments indicated that treatment of the coal as described would not in present circumstances be a commercially profitable process, the cheapness of the waste coal being more than offset by the fact that no residue of saleable coke is left.

IN a paper which appears in the Proceedings of the Royal Society of Edinburgh for the session 1916–17 Dr. John Aitken gives an account of his investigation of the nature of the nuclei present in air on which condensation of moisture occurs when the air is slightly supersaturated. The supersaturation is produced in the usual way by the expansion of the air by amounts which, in Dr. Aitken's apparatus, were 2, 4, 6, or 8 per cent. The smallest expansion causes condensation on the largest nuclei, and it is repeated until no further condensation occurs. Expansions of 4 per cent. then bring down smaller nuclei, and finally expansions of 8 per cent. bring down the smallest investigated by Dr. Aitken. All are much larger than the "small ions" requiring expansions of 25 per cent. to bring them down. Pure air has fewer nuclei of all kinds than polluted air, which, when freshly polluted by combustion or some other chemical process, has a great number of large nuclei, removable by a 2 per cent. expansion, and many requiring expansions up to 8 per cent. The smaller nuclei disappear faster than the larger. Many substances give off nuclei at ordinary temperatures, but heating facilitates the process, especially if chemical action occurs. Dr. Aitken takes exception to the use of the term ions for these nuclei, even when they are electrically charged.

SEVERAL aeronautical articles appear in the issue of the *Scientific American* for October 6. One article deals with the training of airmen in the States, and lays special emphasis upon the importance of the technical instruction which the men receive, enabling them to understand every detail of the mechanical equipment of their machines. A complete report is given of Capt. Hucks's paper on "A Further Three Years' Flying Experience"—noted recently in these columns. An article on "The Classification of Military Aeroplanes" is of some interest, but most of its contents is well known to those who follow aeronautical progress in this country. A short note on the use of kite balloons deserves comment, as these invaluable aids to artillery are seldom mentioned in our periodicals. Their greatest advantage lies in the fact that they are in direct telephonic communication with the battery for which they are "spotting," as the *Scientific American* duly points out. An excellent plate is given illustrating the leading types of German aeroplanes for 1917, together with a table giving their main dimensions, armament, and engine power. Among the shorter articles is one which informs us that America's first "Blimp" is now in commission. Another short note discusses the advantages of the tractor-pusher type of battleplane, a design in which a small car is mounted in front of the airscrew of a tractor machine, giving the gunner an excellent field of fire. This idea is not new, but has not hitherto met with much approval on account of the mechanical difficulties of supporting the forward car.

Engineering for November 23 contains an illustrated article on the armament of aeroplanes, in which reference is made to the arrangements whereby a machine-gun can be fired through the propeller. The German Fokker of 1915–16 had a fixed quick-firing gun mounted in this way, and combined with the engine, so that its firing synchronised with the working of the engine. This method has been adopted on most of the French and enemy machines. Illustrations of a Parabellum gun and also of a Maxim gun with the synchronising device attached are given in the article. The ammunition used by the Germans is also illustrated; the belt contains ordinary, perforating, incendiary, and explosive bullets. The incendiary bullets are hollow and filled with an incendiary material, the basis of which is phosphorus; these bullets produce a trail of light, the object of which is to fire airships and petrol tanks, and also to enable the gunner to correct his range. The perforating bullets consist of a hardened steel core surrounded by a German-silver cover. The belts contain about 10 or 15 per cent. of explosive bullets, the action of which is that of small explosive shells.

SINCE 1906, when Mr. Palin Elderton's useful volume on "Frequency Curves and Correlation" was published, many further advances have been made in statistical method, and the author has now issued an addendum (C. and E. Layton, 1917) with the idea of bringing the book up to date. The first part deals with the exceptional types of frequency-distribution derivable from Prof. Karl Pearson's differential equation, and the second and third parts describe briefly the calculation of a coefficient of correlation for a two-rowed table by Prof. Pearson's method and the correlation-ratio respectively. The pamphlet should be in the possession of all owners of the original work, a list of errata in which is also given. We have also received a reprint of a short paper on the coefficient of correlation by Mr. W. G. Reed, of the U.S. Weather Bureau, from the Quarterly Publications of the American Statistical Association. The paper gives illustrations of the calculation of the coefficient, and a bibliography of the literature. One illustration seems a little misleading, though it is given as a warning. The correlation between the phase of the moon and the height of high-water is found to be near zero. But the phase of the moon is measured by the number of days after full moon; if it were expressed as a periodic function the correlation would be high.

MR. V. C. SHIPPEE contributes to the *Chemical News* for November 2 an interesting note on pure sodium chloride. A specimen prepared by dissolving metallic sodium in distilled water, neutralising with pure hydrochloric acid, and precipitating with hydrogen chloride contained a considerable amount of potassium salt as detected by the flame test. After four recrystallisations from distilled water, however, the purified salt contained only 0·01 per cent. of potassium chloride. A sample prepared and purified in the same way, except that caustic soda "pure by alcohol" was employed, contained 0·03 per cent. of potassium chloride, whilst four recrystallisations of a sample of "C.P." common salt gave a product containing 0·07 per cent. of the same impurity. The chief conclusion drawn is that although potassium chloride obstinately persists with sodium chloride, it can be removed by repeated recrystallisations.

A GREAT deal of information is contained in a paper on gas-firing boilers read by Mr. T. M. Hunter at the Institution of Electrical Engineers on November 22. Mr. Hunter believes that there is a great future for this method of firing boilers, despite the unfortunate experiences which have been the lot of many engineers in the past. Mr. Hunter's paper—which is almost a text-book on the subject—should assist engineers to understand and to obtain the proper conditions for economical gas-firing. In connection with the testing of results, the following extract is of interest:—"The apparatus for boiler control will cost a considerable amount, and it must not be overlooked that the best outfit of recording instruments is useless unless a constant and intelligent use of them is enforced absolutely. If, in addition to this, the boilermen and the man in charge of the boiler plant are given a premium for maintaining good results, boiler control will soon develop into a fine art, and prove an important source of revenue." We think that Mr. Hunter's remarks should be noted by owners of boilers. There are numerous cases where CO_2 recorders, pyrometers, etc., have been installed, and are practically ready for the scrap heap after a few weeks' life, when they have served much the same purpose as toys. On the other hand, if these instruments are kept in thorough working order, and if the workmen are taught to take an intelligent interest in their records, it is astonishing what improvements can be effected in the working of the plant.

WE have received a small booklet from Messrs. Watson and Sons (Electro-Medical), Ltd., of 196 Great Portland Street, W.1, entitled "The Sunic Record," dealing with some recent developments in the production of apparatus for the generation and application of X-rays. The work is edited by Mr. T. Thorne Baker, and is an interesting indication of present activity in the British electro-medical industry. In addition to the description of new apparatus the booklet contains an original article on the suppression of the "inverse" current in induction coils, notes on the X-ray examination of metal castings, radio-active paints, the Coolidge X-ray tube, reviews of books, etc. It is proposed to continue the publication monthly, and the proprietors undertake to send copies to those who will forward their names and addresses.

MESSRS. H. K. LEWIS AND CO., LTD., 136 Gower Street, W.C.1, have sent us a list of the new books and new editions added to their Medical and Scientific Circulating Library during July, August, and September. As the library contains upwards of 13,000 works dealing with medicine, surgery, astronomy, biology, botany, chemistry, electricity, engineering, geology, microscopy, mining, physics, philosophy, sociology, technology, voyages and travels, zoology, etc., and as any recent book of importance which may be applied for, if not already available, is added to it, it should be of great service to science workers. The list will be sent to any address on application.

OUR ASTRONOMICAL COLUMN.

THE TOTAL ECLIPSE OF THE SUN, JUNE 8, 1918.—The total eclipse of the sun on June 8, 1918, will be visible in the United States along a belt having a maximum breadth of sixty miles, extending from the State of Washington, through parts of Oregon, Wyoming, and Idaho, across Colorado and Kansas, and finally reaching Florida about sunset. The duration of totality will diminish from 2m. 2s. at the coast of Washington to less than half that amount in Florida. It is reported in *Science* (October 26) that Profs. Frost and Barnard have made a personal investigation of certain localities, and have decided upon Green River, Wyoming, as the principal station for the expedition from the Yerkes Observatory. Green River is situated between Cheyenne and Ogden, in the so-called Red Desert, and with a rainfall of about 10 in. per year, and an elevation of 6000 ft., it appears to be one of the most promising stations along the belt of totality. The transparency of the air on the day of the visit of the Yerkes astronomers is described as extraordinary. Denver is a possible observing station, but there appears to be some risk of cloud in the Colorado mountains on a June afternoon. It is probable, however, that a spectrograph from the Yerkes Observatory will be attached to the 20-in. equatorial of the University of Denver. Another site very favourably reported upon is near Matheson, Colorado, about sixty miles south-east of Denver, at an elevation of 6000 ft. On account of the war no British expeditions have been organised for observations of this eclipse.

REPORTS OF FRENCH OBSERVATORIES.—From the official report on the provincial observatories of France for 1916 it appears that a large amount of valuable work has been carried on, in spite of the serious depletions of staff which are recorded. Meridian observations, observations of minor planets and comets, and work connected with the astrographic chart of the heavens are prominent features of the reports. Considerable attention has also been devoted to terrestrial magnetism and meteorology. At Lyons M. Luizet has continued his important studies of short-period variables, and numerous observations of double stars have been made by M. Montangerand at Toulouse. The retirement of M. Coggia is announced by the director of the Marseilles Observatory; M. Coggia joined the staff of this observatory in 1866, and was the discoverer of seven comets, of which Comet VII. (1873) and Comet III. (1874) were especially notable.

STRUCTURE OF PLANETARY NEBULÆ.—An investigation of the internal movements and possible structure of the planetary nebulæ 6543 and 7009 of the N.G.C. has been made by Mr. W. K. Green (Lick Observatory Bulletin, No. 298). In each case several long-exposure photographs of the spectrum were taken with different orientations of the slit, so as to give the radial velocity at a large number of points. The central portion of each nebula gives direct evidence of rotation about the shorter axis, but the outer portions along the major axis seem to be rotating in the opposite direction, and some of the observed velocities follow no regular law. Photometric measurements of plates obtained with the Crossley reflector have been made, and curves are given showing the distribution of intensity along various diameters. Both sets of observations point to a rotating ellipsoidal shell as a possible form, but the luminosity curves which have been calculated for such forms are in disagreement with the observations as regards the major axis. An attempt is made to explain the reversal of direction of rotation at the outer ends by supposing that the central ellipsoid is surrounded by a fainter ellipsoidal shell or ring, which rotates in the opposite direction, but this hypothesis is not considered to be entirely satisfactory.